WHAT IS CLAIMED IS:

1. A turbo code decoder which uses likelihood information for redundant parts of a received symbol sequence to update the redundant parts of the received symbol sequence for use by the decoder.

2. The apparatus of claim 1, wherein the turbo code decoder comprises a soft output decoder which provides both likelihood information for a systematic part of the received symbol sequence and likelihood information for redundant parts of the received symbol sequence.

3. The apparatus of claim 2, wherein the redundant likelihood update unit comprises:

a first soft output decoder which generates likelihood information for a first redundant part of the received symbol sequence and a second soft output decoder which generates likelihood information for a second redundant part of the received symbol sequence;

a first compare and update unit which compares the likelihood information for the first redundant part of the received symbol sequence with an original first redundant part of the received symbol sequence and which obtains an updated likelihood value for the first redundant part of the received symbol sequence;

a second compare and update unit which compares the likelihood information for the second redundant part of the received symbol sequence with an original second redundant part of the received symbol sequence and which obtains an updated likelihood value for the second redundant part of the received symbol sequence.

4. The apparatus of claim 1, wherein the turbo code decoder provides likelihood information for a systematic part of a received symbol sequence and wherein the redundant likelihood update unit uses the likelihood information for the systematic part of a received symbol sequence to generate the likelihood information for the redundant parts of the received symbol sequence.

5. The apparatus of claim 4, wherein the redundant likelihood update unit comprises:

a soft output recursive systematic convolutional (RSC) encoder which uses the likelihood information for a systematic part of a received symbol sequence to generate likelihood information for a first redundant part of the received symbol sequence and to generate likelihood information for a second redundant part of the received symbol sequence;

a first compare and update unit which compares the likelihood information for the first redundant part of the received symbol sequence with the original first redundant part of the received symbol sequence and obtains an updated likelihood value for the first redundant part of the received symbol sequence;

a second compare and update unit which compares the likelihood information for the second redundant part of the received symbol sequence with the original second redundant part of the received symbol sequence and obtains an updated likelihood value for the second redundant part of the received symbol sequence.

6. The apparatus of claim 5, wherein the soft output recursive systematic convolutional (RSC) encoder handles a posteriori log likelihood ratio (LLR) values.

7. The apparatus of claim 6, wherein the soft output recursive systematic convolutional (RSC) encoder comprises:

a first adder which receives the likelihood information for a systematic part of a received symbol sequence as a first input to the first adder;

a second adder which receives the likelihood information for a systematic part of a received symbol sequence as a first input to the second adder;

a first shift register which receives an addition result from the first adder;

a second shift register which receives shifted-out contents of the first shift register, the shifted-out contents of the second shift register also being applied as a second input to the second adder;

a third shift register which receives shifted-out contents of the second shift register;

a third adder which receives the shifted-out contents of the second shift register as a first input to the third adder and which receives shifted-out contents of the third shift register as a second input to the third adder, an addition result of the third adder being applied as a second input to the first adder;

a fourth adder which receives an addition result from the second adder as a first input to the fourth adder and which receives the shifted-out contents of the third shift

register as a second input to the fourth adder, an addition result of the fourth adder being a likelihood value for one of the redundant parts of the received symbol sequence;

wherein each of the first adder, the second adder, the third adder, and the fourth adder perform a log-likelihood addition operation.

8. The apparatus of claim 7, wherein the log-likelihood addition operation performs the following operation with respect to a first log likelihood input L(a) and a second log likelihood input L(b):

$$L(a) \boxplus L(b) \equiv L(a \oplus b)$$
$$\approx (-1)x\ sign[L(a)]\ x\ sign[L(b)]\ x\ min[\,|L(a)|, |L(b)|\,].$$

9. The apparatus of claim 1, wherein in updating a redundant part of the received symbol sequence the redundant likelihood update unit performs the steps of:

comparing, on a bit by bit basis, a sign of (1) the likelihood information for a redundant part of the received symbol sequence with a sign of (2) a corresponding original redundant part of the received symbol sequence;

if the signs for (1) and (2) are the same, for an amplitude of the corresponding updated redundant part for the k^{th} symbol of the received symbol sequence using an amplitude of a larger of (1) and (2);

if the signs for (1) and (2) are different, using a sum of (1) and (2) for the corresponding updated redundant part for the k^{th} symbol of the received symbol sequence.

10. The apparatus of claim 1, wherein the redundant likelihood update unit further comprises a timing and control unit which determines timing for operation of the redundant likelihood update unit based on a signal-to-noise ratio (SNR) of received signals.

11. The apparatus of claim 1, wherein the redundant likelihood update unit further comprises a timing and control unit which determines timing for operation of the redundant likelihood update unit based on interim decoding error counts.

12. A wireless radio frequency receiver comprising:

an antenna;

a base band signal processor comprising:

a demodulator which provides a demodulated base band signal;

a turbo decoder which receives the demodulated base band signal which uses likelihood information for redundant parts of a received symbol sequence to update the redundant parts of the received symbol sequence for use by the decoder.

13. The apparatus of claim 12, wherein the turbo code decoder comprises a soft output decoder which provides both likelihood information for a systematic part of the received symbol sequence and likelihood information for redundant parts of the received symbol sequence.

14. The apparatus of claim 12, wherein the redundant likelihood update unit comprises:

a first soft output decoder which generates likelihood information for a first redundant part of the received symbol sequence and a second soft output decoder which generates likelihood information for a second redundant part of the received symbol sequence;

a first compare and update unit which compares the likelihood information for a first redundant part of the received symbol sequence with an original first redundant part of the received symbol sequence and which obtains an updated likelihood value for the first redundant part of the received symbol sequence;

a second compare and update unit which compares the likelihood information for a second redundant part of the received symbol sequence with an original second redundant part of the received symbol sequence and which obtains an updated likelihood value for the second redundant part of the received symbol sequence.

15. The apparatus of claim 12, wherein the turbo code decoder provides likelihood information for a systematic part of a received symbol sequence and wherein the redundant likelihood update unit uses the likelihood information for the systematic part of a received symbol sequence to generate the likelihood information for the redundant parts of the received symbol sequence.

16. The apparatus of claim 12, wherein the redundant likelihood update unit comprises:

a soft output recursive systematic convolutional (RSC) encoder which uses the likelihood information for a systematic part of a received symbol sequence to generate likelihood information for a first redundant part of the received symbol sequence and to generate likelihood information for a second redundant part of the received symbol sequence;

a first compare and update unit which compares the likelihood information for the first redundant part of the received symbol sequence with the original first redundant part of the received symbol sequence and obtains an updated likelihood value for the first redundant part of the received symbol sequence;

a second compare and update unit which compares the likelihood information for the second redundant part of the received symbol sequence with the original second redundant part of the received symbol sequence and obtains an updated likelihood value for the second redundant part of the received symbol sequence.

17. The apparatus of claim 16, wherein the soft output recursive systematic convolutional (RSC) encoder handles a posteriori log likelihood ratio (LLR) values.

18. The apparatus of claim 17, wherein the soft output recursive systematic convolutional (RSC) encoder comprises:

a first adder which receives the likelihood information for a systematic part of a received symbol sequence as a first input to the first adder;

a second adder which receives the likelihood information for a systematic part of a received symbol sequence as a first input to the second adder;

a first shift register which receives an addition result from the first adder;

a second shift register which receives shifted-out contents of the first shift register, the shifted-out contents of the second shift register also being applied as a second input to the second adder;

a third shift register which receives shifted-out contents of the second shift register,

a third adder which receives the shifted-out contents of the second shift register as a first input to the third adder and which receives shifted-out contents of the third shift register as a second input to the third adder, an addition result of the third adder being applied as a second input to the first adder;

a fourth adder which receives the an addition result from the second adder as a first input to the fourth adder and which receives the shifted-out contents of the third shift register as a second input to the fourth adder, an addition result of the fourth adder being a likelihood value for one of the redundant parts of the received symbol sequence;

wherein each of the first adder, the second adder, the third adder, and the fourth adder perform a log-likelihood addition operation.

19. The apparatus of claim 18, wherein the log-likelihood addition operation performs the following operation with respect to a first log likelihood input L(a) and a second log likelihood input L(b):

$$L(a) \boxplus L(b) \equiv L(a \oplus b)$$
$$\approx (-1)x\ sign[L(a)]\ x\ sign[L(b)]\ x\ min[\,|L(a)|, |L(b)|\,] .$$

20. The apparatus of claim 12, wherein in updating a redundant part of the received symbol sequence the redundant likelihood update unit performs the steps of:

comparing, on a bit by bit basis, a sign of (1) the likelihood information for a redundant part of the received symbol sequence with a sign of (2) a corresponding original redundant part of the received symbol sequence;

if the signs for (1) and (2) are the same, for an amplitude of the corresponding updated redundant part for the k^{th} symbol of the received symbol sequence using an amplitude of a larger of (1) and (2);

if the signs for (1) and (2) are different, using a sum of (1) and (2) for the corresponding updated redundant part for the k^{th} symbol of the received symbol sequence.

21. The apparatus of claim 12, wherein the redundant likelihood update unit further comprises a timing and control unit which determines timing for operation of the redundant likelihood update unit based on a signal-to-noise ratio (SNR) of received signals.

22. The apparatus of claim 12, wherein the redundant likelihood update unit further comprises a timing and control unit which determines timing for operation of the redundant likelihood update unit based on interim decoding error counts.

23. A method of turbo code decoder comprising:

generating likelihood information for a systematic part of a received symbol sequence;

using the likelihood information for a systematic part of a received symbol sequence to generate likelihood information for redundant parts of the received symbol sequence; and,

using the likelihood information for redundant parts of the received symbol sequence to update the redundant parts of the received symbol sequence for use by the decoder.

24. The method of claim 23, further comprising:

using at least one soft output decoder to provide (1) likelihood information for a systematic part of the received symbol sequence; (2) likelihood information for a first redundant part of the received symbol sequence; and (3) likelihood information for a second redundant part of the received symbol sequence;

comparing the likelihood information for the first redundant part of the received symbol sequence with the original first redundant part of the received symbol sequence and obtaining an updated likelihood value for the first redundant part of the received symbol sequence;

comparing the likelihood information for the second redundant part of the received symbol sequence with the original second redundant part of the received symbol sequence and obtaining an updated likelihood value for the second redundant part of the received symbol sequence.

25. The method of claim 23, further comprising:

using a soft output recursive systematic convolutional (RSC) encoder to generate likelihood information for a first redundant part of the received symbol sequence and to generate likelihood information for a second redundant part of the received symbol sequence;

comparing the likelihood information for the first redundant part of the received symbol sequence with the original first redundant part of the received symbol sequence and obtaining an updated likelihood value for the first redundant part of the received symbol sequence;

comparing the likelihood information for the second redundant part of the received symbol sequence with the original second redundant part of the received

symbol sequence and obtaining an updated likelihood value for the second redundant part of the received symbol sequence.

26. The method of claim 25, comprising using the soft output recursive systematic convolutional (RSC) encoder for handling a posteriori log likelihood ratio (LLR) values.

27. The method of claim 23, wherein in updating a redundant part of the received symbol sequence the method further comprises:

comparing, on a bit by bit basis, a sign of (1) the likelihood information for a redundant part of the received symbol sequence with a sign of (2) a corresponding original redundant part of the received symbol sequence;

if the signs for (1) and (2) are the same, for an amplitude of the corresponding updated redundant part for the k^{th} symbol of the received symbol sequence using an amplitude of a larger of (1) and (2);

if the signs for (1) and (2) are different, using a sum of (1) and (2) for the corresponding updated redundant part for the k^{th} symbol of the received symbol sequence.

28. The method of claim 23, further comprising determining timing information for generating likelihood information for redundant parts based on a signal-to-noise ratio (SNR) of received signals.

29. The method of claim 23, further comprising determining timing information for generating likelihood information for redundant parts based on interim decoding error counts.